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## PEREGRINE FALCONS KILL A GYRFALCON FEEDING ON THEIR NESTLING

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**KEY WORDS:** *Gyrfalcon; Falco rusticolus; Peregrine Falcon; Falco peregrinus; arctic; food-web; predation; raptor.*

Competition between top predators is critical to the understanding of interactions in food-webs (Chesson and Kuang 2008). Such competition usually results in avoidance and habitat segregation, limiting the risks linked to agonistic behavior. However, such agonistic interactions may be stronger when two closely related species breed in the same habitats and when food resources are limited (Korpimäki 1987, Garcia and Arroyo 2002). This issue is particularly significant in raptors (Orians and Wilson 1964, Sergio et al. 2007); however, there is little information on the occurrence and consequences of competition among raptors breeding in the arctic, partly due to the difficulties of observation inherent to that area.

In North America, there have been several records of agonistic behavior between two closely related species of raptors, the Gyrfalcon (*Falco rusticolus*) and Peregrine Falcon (*F. peregrinus*). Observers have mainly reported evidence of competition for nest sites between the two species (Cade et al. 1998, White et al. 2002, Booms et al. 2008). In addition, Gyrfalcons can also kleptoparasitize foraging peregrines (Dekker 1995). In the Eurasian arctic, however, Gyrfalcons and peregrines overlap only in small patches of trees at the southern border of the tundra, limiting the chance of territorial interactions. In that habitat, Voronin (1986) observed in 1982 that a pair of Gyrfalcons established a nest site on a territory previously occupied by peregrines, which then nested 400 m away from the

Gyrfalcons. Later, the author found one dead fledgling Gyrfalcon and suspected aggression from the neighboring peregrines. Here we document the first report to our knowledge of a peregrine killing a Gyrfalcon that was feeding on a peregrine nestling, in an arctic tundra location outside of the known Gyrfalcon breeding range.

### METHODS

**Study Area.** Our observations were made during an expedition to the Erkutayaha River (68°12'N, 68°59'E), in the southwestern part of the Yamal Peninsula, Russian arctic, from 25 June to 20 August, 2008. This region is classified as low-shrub tundra zone (Walker et al. 2005), characterized by numerous patches of willow thickets (ca. 1.5 m high) but no trees. Our study area included the Erkutayaha and Payutayaha rivers, which fuel a network of lakes and flooded areas during spring and flow through a matrix of flat tundra interspersed with hills (ca. 30 m high) and sand cliffs up to 40–50 m high. Such cliffs form the primary substrate for peregrine nests (Kalyakin 1989), and are mostly present on the riverbanks and lakeshores.

The Yamal Peninsula harbors one of the largest and most stable populations of peregrines in the Russian arctic (Osmolovskaya 1948, Danilov et al. 1984, Paskhalny et al. 2000, Mechnikova and Kudryavtsev 2005, Ryabitsev 2008). The northernmost border of the Gyrfalcon range extends to the southern base of the peninsula close to the forest-tundra ecotone and along the rivers in riparian forests. In this area, the Hadtya, Yadayahodiyaha, and Schuchya rivers (67°20–30'N, 67°10–50'E; Danilov et al. 1984, Mechnikova et al. 1999) host stable nesting Gyrfalcon populations, with the Schuchya River having the most eyries (Kalyakin and

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Vinogradov 1981, Danilov et al. 1984, Kalyakin 1998, Mechnikova and Kudryavtsev 2005, 2008). In the Eurasian arctic, in contrast with the North American arctic and Greenland, Gyrfalcons nest more often in trees (using old nests of other species, primarily White-tailed Eagle [*Haliaeetus albicilla*], Common Raven [*Corvus corax*] and Rough-legged Hawk [*Buteo lagopus*] in the forest-tundra ecotone, than on the cliffs (Danilov et al. 1984, Kalyakin 1989, Obst 1994, Morozov 2000, Mechnikova and Kudryavtsev 2005, 2008). Our study area, encompassing the Erkutayaha River, is >100 km north of the northernmost known nesting territory of Gyrfalcon. Nevertheless, flying individuals were repeatedly observed in the vicinity, either in summer (end of August 1989 and 24 July 2000; Shtro et al. 2000) or in winter (1 March and 17 April 2008; Sokolov et al. in press). To the north, wandering Gyrfalcons were observed along the arctic coastline of the Yamal Peninsula (Ryabitsev 2008).

**Survey Methods.** We monitored an area of ca. 250 km<sup>2</sup>, targeting riverbanks and lakeshores, with boats and on foot, using 8–10× binoculars. For all raptor nests, we recorded location using a Global Positioning System receiver, collected pellets, and recorded prey remains (e.g., wings, bones). In addition, we measured wing, tarsus, and culmen length of all peregrine nestlings.

For six peregrine nests, we regularly repeated the collection of prey remains and nestling measurements (two visits per nest on average). We installed automatic cameras (Digital Ranger W50 RB with Sony Cyber-shot DSC-S700 camera; Camtrak South Inc., Watkinsville, Georgia, U.S.A.) near these four nests, taking one photograph every 10 min to record parent and offspring activity and prey consumption throughout the nestling period.

## RESULTS

We found 10 peregrine nests in the survey area. We did not detect any other raptor breeding activity, except one Rough-legged Hawk pair nesting 300 m from the peregrine nest later attacked by the Gyrfalcon. This attack was the only evidence of intraguild predation among raptors in the area; we did not record any similar interaction either with our automatic cameras ( $n = 9100$  photos) or during all our visits to raptor nests (1–4 visits for each nest). In addition, we did not find any remains of any raptor in all the collected pellets and prey remains ( $n > 100$  pellets and remains).

The Gyrfalcon-peregrine predation occurred at the end of the nesting period, when peregrine nestlings were fully grown and feathered, with a few patches of down still visible, and had begun making their first flights. During our visit to a peregrine nest on 17 August at 12:00 H, we found dead both the smallest nestling of the peregrine brood and an immature Gyrfalcon nearby (ca. 1.5 m). The dead nestling had been partially eaten (approximately one quarter of the right breast muscle) and the Gyrfalcon had feathers from the breast of the nestling peregrine in its bill. The Gyrfalcon's back showed deep, narrow and oval

scars, typical after a talon attack. This Gyrfalcon was identified as a probable yearling, based on its distinctive coloration (white edging on back and wing feathers), mass (770 g), and morphometric measurements (wing chord 370 mm). The Gyrfalcon likely was in poor physical condition, as we could feel a prominent bony keel. As Gyrfalcon are rare in the area and no nest was found, the immature bird involved in the interaction was not likely a resident.

The death of the two birds could not have occurred more than 1 hr before our visit to the nest, because the blood of the nestling had not yet coagulated. In addition, the two fledglings left alive in the brood were still flying around with their alarm-calling parents as we approached the nest. Based on this evidence, we concluded that the Gyrfalcon attacked the peregrine nestling in the nest, killed it, and, while eating the nestling, the Gyrfalcon was hit by one or two adult peregrines and died shortly thereafter.

## DISCUSSION

We here describe a complex case of aggressive interactions between raptors, encompassing an immature Gyrfalcon, a nestling peregrine, and an adult peregrine pair. There are previous reports indicating that peregrines can become prey of other raptors, e.g., Golden Eagle (*Aquila chrysaetos*) and Eurasian Eagle-Owl (*Bubo bubo*; Cainzaraian et al. 2000, Craig and Enderson 2004, Sergio et al. 2004, Sergio and Hiraldo 2008). In addition, Booms and Fuller (2003) found adult peregrine remains in Greenland Gyrfalcon pellets, but there was no evidence that the Gyrfalcon actually killed the peregrine rather than simply fed on its carcass. We know of one observation in which a peregrine in flight attacked an adult female Gyrfalcon (which later died from a subsequent Bald Eagle attack; White et al. 2002), as well as one case in which the author suspected such aggressive interaction (Voromin 1986). Our report adds further evidence that aggressive interactions between the two species may be instigated by either species.

In the case we report, the Gyrfalcon may have been heavier than the peregrine nestling it was feeding upon (we do not have the nestling body mass, but the size of the Gyrfalcon indicated possible larger body mass). At the species level, Gyrfalcons average 1.5 times heavier than the arctic subspecies of peregrine (Gyrfalcons average 1192 g for males, 1940 g for females, compared to 710 g and 1133 g for male and female peregrines, respectively; Dementiev et al. 1951). In this case, however, the immature Gyrfalcon's body mass was only 770 g, ca. 30% lighter than a female adult peregrine. This mass was quite low, given that its wing chord was close to that of an adult Gyrfalcon; this may have been symptomatic of starvation, which may have been a consequence of low prey availability associated with a low phase of the small-mammal cycle (N. Lecomte, I. Pokrovsky, A. Sokolov, and N. Yoccoz unpubl. data). According to life-history theory, mutual predation and aggression in top predators, which are long-lived, should be uncommon, due to the risk of injury or death resulting

from counterattack by the intended prey. Poor body condition and/or inexperience may trigger risky behavior (e.g., McNamara and Houston 1994); the immature and dispersing Gyrfalcon may have paid the price for its inexperience in the peregrine territorial defense.

**FALCO PEREGRINUS MATA A UN INDIVIDUO DE *F. RUSTICOLUS* QUE SE ENCONTRABA DEPREDANDO A SUS POLLUELOS**

**RESUMEN.**—La competencia entre depredadores tope es importante para entender las interacciones en las tramas tróficas. Sin embargo, existe poco conocimiento sobre la ocurrencia y las consecuencias de la competencia entre aves rapaces que crían en el ártico, en parte debido a las dificultades de obtener registros por las características inherentes del área. Las interacciones entre los depredadores tope de la tundra *Falco rusticolus* y *F. peregrinus* han sido observadas frecuentemente en el Ártico de Norteamérica pero raramente en el Ártico de Eurasia, probablemente debido a la escasa superposición de las áreas de cría de estas dos especies de halcones en el Ártico europeo. De acuerdo a nuestro conocimiento, este es el primer registro de que halcones de la especie *F. rusticolus* pueden afectar el éxito reproductivo de *F. peregrinus* al matar a sus polluelos, y que esta depredación es arriesgada ya que los adultos de *F. peregrinus* pueden herir o matar a los halcones *F. rusticolus*. Este caso de interacción agresiva fue inesperado porque ocurrió fuera del área de cría de *F. rusticolus* en la península Yamal, en el Ártico de Rusia.

[Traducción del equipo editorial]

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